III Year I Semester	L	T	P	C
Code: 20ME5761	3	1	0	4

BIO MATERIALS

Course Objectives:

The Students will acquire the knowledge:

1. To interpret the Definition of biomaterials.
2. To discuss the metallic implant materials.
3. To outline the systematic understanding of knowledge in polymeric implant materials.
4. To discuss about ceramic and composite implant materials.
5. To outline the biocompatibility & toxicological screening of biomaterials.

UNIT-I INTRODUCTION:

Definition of biomaterials, requirements & classification of biomaterials, Comparison of properties of some common biomaterials.Effects of physiological fluid on the properties of biomaterials.Biological responses (extra and intra-vascular system).Surface properties of materials, physical properties of materials, mechanical properties.

UNIT-II METALLIC IMPLANT MATERIALS:

Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking.Host tissue reaction with bio metal, corrosion behavior and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants, Dental implants. Soft tissue replacement implants: Percutaneous and skin implants, Vascular implants, Heart valve implants-Tailor made composite in medium.

UNIT-III POLYMERIC IMPLANT MATERIALS:

Polyolefin's, polyamides, acrylic polymers, fluorocarbon polyme rs, silicon rubbers, acetyls. (Classification according to thermo sets, thermoplastics and elastomers).Viscoelastic behavior: creep-recovery, stress-relaxation, strain rate sensitivity. Importance of molecular structure, hydrophilic and hydrophobic surface properties, migration of additives (processing aids), aging and environmental stress cracking.Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications.

UNIT-IVCERAMIC IMPLANT MATERIALS:

Definition of bio ceramics. Common types of bioceramics: Aluminum oxides, Glass ceramics, Carbons. Bio resorbable and bioactive ceramics. Importance of wear resistance and low fracture toughness.Host tissue reactions: importance of interfacial tissue reaction (e.g. ceramic/bone tissue reaction).

COMPOSITE IMPLANT MATERIALS: Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers, fibers pull out). Polymers filled with osteogenic fillers (e.g. hydroxyapatite). Host tissue reactions.

UNIT-V BIOCOMPATIBILITY & TOXICOLOGICAL SCREENING OF BIOMATERIALS:

Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies (in situimplantation, tissue culture, haemolysis, thrombogenic potential test, systemic toxicity, intracutaneous irritation test), sensitization, carcinogenicity, mutagenicity and special tests.

TEXT BOOKS

1. Biomaterials Science: An Introduction to Materials in Medicine, By Buddy D. Ratner, et. al. Academic Press, San Diego, 1996.
2. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.
3. J B Park, Biomaterials – Science and Engineering, Plenum Press, 1984.

Course Outcomes:

At the end of the course, the student will be able to:

1. Outline the appropriate Definition of biomaterials.
2. Select between metallic implant materials.
3. Apply a systematic understanding of knowledge in polymeric implant materials.
4. Describe the utility of ceramic and composite implant materials.
5. Integrate the knowledge of biocompatibility & toxicological screening of biomaterials.